

ERIC Document Resume		See Instruction Sheet		DATE OF RESUME		DATE RECEIVED	
A. PUBLICATION DATA							
1. ERIC NUMBER ED002413		2. ORIGINATOR CONTROL NO(S). N.A.		3. IDENTIFICATION NO. N.A.		DO NOT WRITE IN SPACE BELOW MICROFILM COPY AVAILABLE YES ☒ NO ☐ COPYRIGHT GRANTED YES ☐ NO ☒ COPYRIGHT RELEASE FILED YES ☐ NO ☐ TYPE OF REPORT PROPOSAL ☐ IN-PROGRESS ☐ FINAL ☒ FOLLOW-UP ☐ OTHER ERIC REFERENCES: ERIC SATELLITE CODE	
4. AUTHOR(S): N.A.							
5. TITLE OF DOCUMENT ABSTRACTED: Some Applications of Programed Instruction for Alleviation of Poverty							
6. PUBLICATION TITLE: N.A.							
7. EDITOR(S): N.A.		8. PLACE OF ORIGIN ORG. N.A. ST. CITY, STATE TELE. EXT. INST/LOC CODE					
9. PUBLISHER OR SOURCE N.A.							
10. VOL. N.A.	11. PAGES N.A.	12. MO./YR. N.A.	13. TOTAL PP. 16				
B. INDEXING DATA							
14. SUBJECT AREA				15. TYPE OF ENDEAVOR Report			
16. INDEXING TERMS (6-12)							
programed instruction				self-instruction			
poverty				self-instructional program			
instructional technology				teaching machines			
17. ABSTRACT (MAX. 250 WORDS)							
There are three circumstances in which the educator may decide that programs should be presented by machine, rather than in book format: when the program requires presentation of a wider range of stimuli than is possible in more conventional formats; when there is need for more control over student performance than is possible in book format; and when repeated use of a teaching machine may result in savings in cost. Research on the effectiveness of programed instruction indicates: (1) A good program is one in which the training objectives and the characteristics of the students for whom the program is intended are explicitly stated. (2) The program should have been tested on representative students from the intended population and revised to take into account tryout data. (3) Learning from a good program should compare favorably with learning from conventional teaching situations. The uses to which programed instruction can be put in educational activities in poverty-stricken regions involve expansion of educational opportunity, increased individualization of instruction, and more effective use of teachers. Education agencies can develop programs to answer local needs and apply the techniques of program development to produce other teaching materials. In the selection of self-instructional programs, the teacher or selection committee should first state as explicitly as possible the outcomes desired from the program. The evaluator should then survey the titles of programs available in the chosen subject area. Evaluation should provide information about appropriateness of content, program effectiveness, and usability.							
18. SOURCE OF ABSTRACT							
C. FUNDING DATA							
19. SUPPORTING ORGANIZATION				20. DIVISION OR DEPT.		21. CONTRACT NO.	
						PROJECT NO.	
				22. TOTAL COST OF PROJECT			
				23. DURATION OF PROJECT		U.S. Department of Health, Education, and Welfare Office of Education	

U. S. DEPARTMENT OF HEALTH, EDUCATION AND WELFARE
Office of Education

This document has been reproduced exactly as received from the person or organization originating it. Points of view or opinions stated do not necessarily represent official Office of Education position or policy.

Some Applications of Programed Instruction
for Alleviation of Poverty

ED0002413

1. What is Programed Instruction?

Since the first widespread popular interest in programed instruction in 1958, the number of self-instructional programs available for purchase has increased at a phenomenal rate. In 1960, not a single program covering as much as a full semester's work in any subject area normally taught in the curriculum was generally available. By September 1962, approximately 120 programs had been published commercially for educational use, and just one year later the number of programs being marketed had risen to more than 350.

For purposes of this paper, a self-instructional program is defined as a teaching material intended for use by the individual student who works at his own pace, requiring frequent student response and providing the student knowledge of the correctness or incorrectness of his response. The sequence, and to a degree, the scope of a self-instructional program is determined by repeated try-out of the draft program with students chosen from the target audience for the program, followed by revision of the program on the basis of the student tryouts. As a result, students from the intended population can proceed through the final version of the program with a relatively small number of errors in the responses they make.

7

2. What About Teaching Machines?

Many persons confuse the relationship of teaching machines to programed instruction. It should be noted that it is not the machine, but the

J0518

ED00 24 13

program that teaches; all that a teaching machine does is to present the self-instructional program. At the present time no teaching machine on the market will accommodate all, or even a majority of the programs available. Indeed, the overwhelming preponderance of self-instructional programs--well over 90% of those available--may be used without a teaching machine.

The knowledgeable educator first makes a choice of the self-instructional program(s) he wishes to use, and then decides whether or not the purchase of teaching machines to present those programs is necessary or desirable. He will also recognize the fact that he has no assurance that all the programs best suited to his purposes may be presented by the same machine.

In general, there are three circumstances in which he may decide that the programs should be presented by machine, rather than in book format:

A. The program requires presentation of a wider range of stimuli than is possible in more conventional formats. If a program involves the use of recorded materials, extensive use of pictorial materials, color, or motion photography, something more elaborate than a book presentation is necessary.

B. There is need for more control over student performance than is possible in book format. If there is need for oral, psychomotor or other kinds of responses by the student which cannot be accommodated by writing a response or selecting one of a number of alternative answers, a teaching machine will be required. In like manner, if there is need

for automatic sequencing of the program contingent on the students' responses, if there is need for continuous record-keeping, or pacing of the presentation of parts of the program, use of a teaching machine may be indicated.

C. Repeated use of a teaching machine may result in savings in cost. Many self-instructional programs are quite bulky and require a great deal of storage space. Many others, if presented in book format, are consumed after one use by a student. If it is anticipated that there will be repeated use of the program for a number of semesters, a reusable program presented by machine may cost less per student than purchase of book-format programs.

Unless one or more of these three conditions exist, the educator will probably decide that he will not purchase teaching machines to present the programs he intends to use.

3. What Do We Know About the Effectiveness of Programed Instruction?

A rather substantial body of research on programed instruction has built up in recent years. This research evidence indicates:

A. A good program is one in which the training objectives and the characteristics of the students for whom the program is intended are explicitly stated. The program should have been tested on representative students from the intended population and revised to take into account try-out data.

There has been much discussion about whether a program should be "linear," i.e., all students go through exactly the same sequence of

4

material, or "branching," i.e., the sequence of the program is determined by the individual student's response. The research evidence suggests that no single programing rationale is universally superior. Instead, the nature of the program appears to relate to the objective to be attained, the characteristics of the students, and the nature of the subject matter to be taught. Similarly, there appears to be no universal merit in programs requiring the student to construct his responses, or in those in which the student selects one of a number of alternative answers set out for him by the programmer.

No matter how well a program is constructed, it probably cannot be used for all educational populations. In developing a program, it is desirable to tailor it to a population which can be described in terms of reading level, general ability level, prior knowledge of the subject, and aspirations or motivations to learn. A program developed for and field tested on "average" 6th grade students may simply bore academically advanced or creatively gifted students of approximately the same age. A program tested and revised on tryouts with suburban children may be based on assumptions regarding prior knowledge, aspirations, or values that will not hold true in economically or culturally disadvantaged groups.

7

B. Learning from a good program compares favorably with learning from conventional teaching situations. If a program has been carefully chosen for a particular group of students, it will probably attain the specific objectives for which it was intended at least as well as conventional instruction. This will be reflected in either more rapid attainment of the level of performance required, or performance at a higher level than is normally found in more conventional teaching. It is

unlikely, however, that one will find a given student performing both more rapidly and more effectively. It is also unlikely that one will find that a single program will attain all the objectives one has for instruction in a given class. An example of the objective of a good program is the following:

Upon completion of this program, a student with 8th grade reading level will be able to read the editorial page of a French language newspaper in 30 minutes without the use of a dictionary and pass a comprehension test with a score of 80% correct answers.

Reading proficiency in a foreign language is only one objective of language teaching. One should not expect this program to teach grammar, oral skills, or aural skills in the language--it makes no pretense of doing so. But by attaining the objective for which it is intended, it may permit the teacher to focus her attention on other objectives to be attained in the course.

C. There are many 'correct' ways to use programed instruction.

It appears possible for programed instruction to be used for the complete instructional experience of students--for limited purposes--if no competent teacher is available. However, better results are possible if the program is used by a competent teacher who has available a variety of other teaching resources and materials. How to use a program most effectively depends to a large degree on the teaching style of the teacher and the characteristics of the students to be taught. There are cases reported in which a given program has been

quite successful in one situation and highly unsuccessful in another. This disparity in results is largely attributable to the effectiveness of the teacher in articulating the program into a total plan for instruction. An increasing number of programs are now coming on the market with teachers' guides which describe the effectiveness of the program under differing conditions of use. After reading such guides, it is advisable to try to accommodate these reported experiences to local conditions.

For some descriptions of actual uses of programmed instruction in the schools, the reader is referred to a recent publication of the Fund for Advancement of Education, Four Case Studies of Programed Instruction^{1*}

A number of summaries of research on programed instruction are available. The most recent is The Research on Programed Instruction: An Annotated Bibliography.²

4. What Are Some Possible Uses of Programed Instruction for Alleviation of Poverty?

The uses to which programed instruction can be put in educational activities in poverty-stricken regions involve one or more of each of the following: (a) expansion of educational opportunity; (b) increased individualization of instruction; and (c) more effective use of teachers.)

The following examples of using programed instruction are intended to be illustrative only. Additional uses may be possible in some practi-

* All references are listed at the end of this paper.

tical situations, and the uses suggested herein may require some modification to local conditions.

One major possibility for using programed instruction is to assign individual students to complete a program in a subject area in which no qualified teacher is available. Thus, a course in calculus might be taught to a group of widely scattered students through the use of programed instruction. In a similar manner, programed instruction might be used as a means of providing special in-service training to teachers. In such uses of programed instruction, careful efforts should be made to assure the appropriateness of the program to the intended user through pre-testing, interviews, or examination of academic records.

It would also be desirable to articulate the use of programed materials with other instructional experiences. For example, the program might be used as one component in a correspondence course, or be coordinated with an instructional television series. A third possibility would be to have the individual's use of the program supplemented by periodic discussion sessions, preferably conducted by a competent instructor, but possibly conducted by the group itself unsupported by outside resources.

Under present conditions, such uses of programed instruction probably will not result in as effective learning as might be expected from continued interaction of teacher and students in a more formal teaching situation. It will however, provide a means of carrying on a training

program where none is feasible otherwise.

A second broad type of use is to use self-instructional programs within a more conventional teaching situation to provide special instruction required by individual members of the class. In a normal, heterogeneously grouped class, one frequently finds the need to provide special remedial work for some students, and advanced or enrichment activities for one or two able students. Programed instruction provides one means of providing for such individual needs. The student who is behind the rest of the class may be provided one of a number of programs which will permit him to upgrade needed skills during out-of-school hours, while participating in class activities during the day. The able student can be provided with programed materials which relate to class work but are at an advanced level, so that he may make full use of his potential and avoid the boredom which afflicts so many gifted students who are chained to the pace of the class. Such uses are most possible at present in the areas of mathematics and English, where a large number of programs is available, but less possible in most other subject areas, in which there are shortages of programs.

7. A third possible use of programed instruction would be as an integral component of class experience for all students. One technique of using programed instruction in this manner is to assign a program to an entire class. The teacher then checks on the progress of the students and, at appropriate intervals, groups them according to their degree of progress through the program. She then discusses and plans additional experience

for the most rapid learners, gives advice and assistance to the intermediate group, and provides necessary remedial work for the slower learners. During the time that the students are working on the program in class, the teacher is available for individual counseling and assistance.

In some instances, depending upon the students, the subject, and the instructional style of the teacher, it is preferable to use the program as a textbook is usually used. In this case, the teacher will conduct discussions and recitations during class periods, and make specific assignments from the self-instructional program at appropriate times. Such a use of a program tends to minimize its value as a means of individualizing instruction, but is more compatible with conventional teaching procedures.

It should be noted that commercially available programs may not serve all the needs of the school. Under such conditions, the school administrator may consider the advisability of having some programs produced locally for his own needs. Local programing efforts have the advantage of assuring the appropriateness of the materials to local needs. However, this may be overbalanced in some cases by the heavy expenditure of funds and staff effort to develop the program.

Such local programing efforts can be based in the school, making use of competent teachers, but teachers must be supported by a psychologist or some other person knowledgeable in programing techniques. At present,

few school districts have a person with the requisite skill and knowledge to provide teachers the specialized assistance they will require. However, the Office of Education is supporting a project³ which is expected to lead to a self-instructional program on programing techniques. It is hoped that this program will be available by the opening of schools in 1965.

It should be reiterated that program development is an empirical process, in which the program is only as good as the try-outs and revisions through which it goes. Although each programmer proceeds in a different manner, the following general procedure has been used frequently:

- A. Define the instructional objectives for the program in behavioral terms. (cf. Mager⁴)
- B. Specify the entering repertoire of behavior for students who will use the program.
- C. Analyze the chain of behaviors from the entering behavior of the intended students to the objective to be attained.
- D. Develop, or select, one or more measuring instruments to assess the effectiveness of the program. (Note: the means of assessing the effectiveness of the program should be identified prior to development of the program itself.)
- E. Analyze the subject matter to be taught in light of the chain of behaviors to be developed by the program.
- F. Write the initial draft of the program.
- G. Try out the initial draft of the program on an individual or a small (3-5) group of students and revise the draft program.

H. Repeat the try-out and revision step with new students until the cumulative error rate for student responses is below 10%.

I. Field test the program in one or more class settings, paying particular attention to means of articulating the program with total course procedures and objectives.

J. Develop a teacher's manual, reflecting field-test experience, to accompany the program.

This procedure may be expected to require a minimum of four hours of programing effort for every class-hour of usable program produced. It may be justified, however, if the end-product gives some assurance of assisting the more effective attainment of an important educational objective. It should also be noted in passing that this technique of program development can be adapted to development of more effective motion pictures,⁵ television programs,⁶ and other instructional materials.

5. How Should One Select a Self-Instructional Program?

As the foregoing discussion has indicated, good self-instructional programs are tailored to learning objectives and student characteristics in a more precise manner than most teaching materials. Unless the individual teacher or school administrator makes sure that the program selected for his class is appropriate to the instructional purposes he has in mind and to the capabilities of his students, he cannot expect the program to be fully effective.

To assist the educational practitioner in the evaluation of programs, the Office of Education has supported, under contract, work of a joint

committee on programed instruction of the American Educational Research Association, the American Psychological Association, and the Department of Audiovisual Instruction of the National Education Association.⁷ This committee has developed a number of statements concerning the nature, selection, and use of programed instructional materials. The first report of the committee, published in the July-August 1961 issue of A-V Communication Review, the September 1961 issue of Audiovisual Instruction, and the November 1961 issue of the NEA Journal, gives general guidance concerning programed instruction and teaching machines. The second interim report, concerned with criteria for assessment of programed instructional materials, is summarized in the November-December issue of School Life.⁸

In the selection of self-instructional programs, the teacher or selection committee should first state as explicitly as possible the outcomes desired from the program. Insofar as possible, these outcomes should be stated in terms of desired student behaviors, as described above. In a similar manner, relevant abilities and prior knowledge of the intended students should be stated in operational terms.

The evaluator may then wish to survey titles of programs available in the chosen subject area. Two sources of information are Programs '63⁹ and Programed Learning: A Bibliography of Programs and Presentation Devices.¹⁰ The latter compilation includes the titles of more programs, is more current, and is updated periodically, but Programs '63 provides somewhat more detailed information on the programs it lists.

This initial scanning will identify which, if any, programs appear worthy of more detailed review. At this point, it will be necessary to acquire at least one complete copy of each program to be scrutinized, since further evaluation must be conducted using the program itself.

Evaluation should provide information about:

- A. Appropriateness of Content, that is, what does the program attempt to teach? What could be learned if the material covered is taught effectively?
- B. Program Effectiveness, that is, how well does the program teach? Rothkopf¹¹ suggests two indices of effectiveness: "internal" evidence, which can be garnered from inspection of the program, and "external" evidence, which must be collected by means other than inspection. Almost all that can be learned from internal evidence at present is how appropriate the program content is to the user's objectives. Thus, it is recommended that external evidence be used in assessing program effectiveness.
- C. Usability - is the program practical for use operationally in the local setting? This criterion will be of assistance in considering the administrative, financial, and classroom utilization requirements which use of the program might impose.

The evaluators should scan the program to determine the appropriateness of the content taught, the relevance of student responses required to the objectives of the course, the format, machine requirements, cost, and reusability of the program being considered. This inspection, therefore, if conducted by persons knowledgeable in the content area,

should provide all needed information on the criterion of content-appropriateness. It will also provide internal information on program effectiveness and some limited insight into the usability of the program. Additional, external, information may be collected from examination of any manual or teachers' guide which accompanies the program. Useful information which such a manual may provide includes: (a) qualifications of the authors of the program; (b) history of development of the program, including try-outs and revisions; (c) characteristics of students upon whom the program has been tested and revised; (d) conditions under which the program has been used; (e) performance or other tests used with students who have been exposed to the program; and (f) evidence of program effectiveness as reflected through test scores of students who have used the program.

If, after such inspection, a program still appears to have potential usefulness, it should be tested locally on some students from the intended population. Two different types of field tests have been used separately or in combination. Each has advantages and each has limitations.

The simplest field test involves selection of a small number of individuals (3-10) who are "typical" of the population and who have not yet taken the course in question. These students are then assigned to completion of the program, after which they are administered an achievement test. Other sources of information during such a try-out are anecdotal records from observers, comments from the test subjects, and time for completion of the program. Such a try-out will not indicate,

however, the relative effectiveness of differing roles a teacher may play during use of the program or the effects of the program on motivation or classroom management.

A second type of field test involves the use of the program with one or more complete classes. Such a field test will provide fuller information on usability of the program in operational settings, but is more likely to require the use of statistical procedures and experimental controls than try-outs with individual students. As a result, many educators recommend a two-stage field test, involving first a try-out on a few individual students, followed by a field test with a full class. Such a procedure permits close observation of individual effects of the program, coupled with the wider range of evidence available from use of normal classroom environments, but extends the evaluation process over a time period which is impractical in many educational situations.

6. Conclusion

In brief, the new instructional technology of programmed instruction is extremely promising as a means of educating to alleviate poverty.

Programed materials can be used in a variety of ways for expanding educational opportunity, individualizing instruction, and for permitting more effective use of teacher resources. There is also the possibility of education agencies developing programs to answer local needs and of applying the techniques of program development to production of other teaching materials. The potential user is cautioned, however, that a careful evaluation program should be undertaken prior to widespread adoption of a given program.

REFERENCES

1. Edling, Jack V., Foshay, Arthur W., et al., Four Case Studies of Programed Instruction. New York, The Fund for the Advancement of Education, June 1964.
2. Schramm, Wilbur, The Research on Programed Instruction: An Annotated Bibliography. Washington, D.C., U.S. Government Printing Office (OE-34034), 1964
3. "Development of a Programed Textbook Course Teaching the Principles and Procedures of Preparing Programed Instructional Materials," Contract OE-4-16-027 between the U.S. Department of Health, Education, and Welfare, Office of Education, and William A. Deterline.
4. Mager, Robert F., Preparing Objectives for Programed Instruction. San Francisco, Fearon Press, 1962.
5. May, Mark A., and Arthur A. Lumsdaine, Learning from Film. Hartford, Yale University Press, 1958.
6. Gropper, George L., and Arthur A. Lumsdaine, The Use of Student Response to Improve Televised Instruction: An Overview. Pittsburgh, American Institute for Research, 1961
7. "Study, Formulation, and Dissemination of Technical Information on Auto-Instructional Programs, Devices, and Research," Contract SAE-9538 between the U.S. Department of Health, Education, and Welfare, Office of Education, and the American Educational Research Association.
8. Lumsdaine, Arthur A., "Criteria for Evaluating Self-Instructional Programs." School Life, U.S. Department of Health, Education, and Welfare, Office of Education, November-December 1962.
9. Hanson, Lincoln F., ed., Programs '63: A Guide to Self-Instructional Programs Available to Editors by September, 1963. Washington, D.C., U.S. Government Printing Office (OE-34015-63), 1963.
10. Handershot, Carl H., Programed Learning: A Bibliography of Programs and Presentation Devices. 4114 Ridewood Drive, Bay City, Michigan, 1964.
11. Rothkopf, Ernest Z., "Criteria for the Acceptance of Self-Instructional Programs," in Traxler, A. E., Improving the Efficiency and Quality of Learning. Washington, D.C., American Council on Education, 1962.